

CLAIMS

1. A method comprising:
directing an energy beam at a pre-processed composite material having a matrix containing a plurality of nanocrystals and a plurality of traps to reduce the size of said plurality of nanocrystals and the number of the plurality of traps to produce a post-processed composite material.
2. The method of claim 1, wherein said nanocrystals are from the group consisting of Group II-VI, Group III-V and Group IV semiconductor materials capable of emitting visible light upon excitation.
3. The method of claim 1, wherein said nanocrystals are ZnSe.
4. The method of claim 1, wherein said plurality of traps are from the group consisting of impurities that are capable of producing light emission upon excitation.
5. The method of claim 1, wherein said traps are from the group consisting of Se molecules, Se vacancies, or zinc vacancies.
6. The method of claim 1, wherein said matrix material is a transparent material that may contain said nanocrystals and traps that emit in the visible light range when fluoresced.
7. The method of claim 1, wherein said matrix material is a glass material.

8. The method of claim 1, wherein said matrix material is a potassium borosilicate material.

9. A method comprising:

directing an energy beam at a first state composite material having a plurality of nanocrystals and a plurality of traps to reduce the size of the nanocrystals and the number of said plurality of traps to produce a second state composite material capable of white light emission when fluoresced.

10. A method comprising:

fluorescing a pre-process composite material having a plurality of nanocrystals and a plurality of traps to obtain a light emission spectrum;
performing an analysis of said light emission spectrum;
directing an energy beam at the pre-process composite material to reduce the size of the plurality of nanocrystals and to reduce the number of the plurality of traps to produce a post-process composite material capable of white light emission when fluoresced.

11. A method of controlling the white light emission of a composite material comprising:

irradiating with an energy beam said composite material to reduce the size of a plurality of nanocrystals positioned in said composite material and to reduce the number of a plurality of traps positioned in said composite material.

12. A method of controlling the white light emission of a composite material comprising:

laser irradiating said composite material to reduce the size of a plurality of blue light emitting nanocrystals and to reduce the number of red and green light emitting traps.

13. A method comprising:

1) fluorescing a pre-process composite material having a plurality of nanocrystals and a plurality of traps to obtain a light emission spectrum;

2) performing an analysis of said light emission spectrum;

3) directing an energy beam at the pre-process composite material to reduce the size of the plurality of nanocrystals and to reduce the number of the plurality of traps to produce a post-process composite; and

4) repeating steps 1, 2 and 3 until a predetermined white light emission is obtained.

14. A material system produced by the method of claim 1.

15. A material system produced by the method of claim 10.

16. A material system comprising:

a plurality of nanocrystals;

a plurality of first and second traps; and

said plurality of nanocrystals, first traps and second traps capable of emitting white light in combination when excited.

17. The material system of claim 16, wherein said nanocrystals are from the group consisting of Group II-VI, Group III-V and Group IV semiconductor materials capable of emitting visible light upon excitation.

18. The material system of claim 16, wherein said nanocrystals are from the group consisting of ZnSe, CdSe, and CdS.

19. The material system of claim 16, wherein said first and second traps are from the group consisting of impurities that emit red and green light.

20. The material system of claim 16, wherein said first and second traps are from the group consisting of Se molecules, Se vacancies and zinc vacancies.

21. The material system of claim 16, further including a glass material.

22. The material system of claim 16, further including potassium borosilicate glass.

23. A material system comprising:

a plurality of nanocrystals designed to emit blue light when excited and having an average particle size of 1 to 20 nanometers;

a plurality of first traps designed to emit red light when excited; and

a plurality of second traps designed to emit green light when excited.

24. A material system comprising:

a matrix including nanocrystals having particle sizes in the range of 1 to 20 nanometers; and

said matrix further including first traps configured to emit red light and second traps configured to emit green light when fluoresced.

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25. A material system capable of white light emission when excited comprising:

a matrix having a plurality of nanocrystals; and
said plurality of nanocrystals configured to contribute in the blue spectral
range of the white light emission from the quantum confined bandedge emission
of said nanocrystals when excited.

26. The material system of claim 25, further comprising:

a plurality of first and second traps; and
said first traps configured to contribute in the red spectral range of the
white light and said second traps configured to contribute in the green spectral
range of the white light when excited.

27. The material system of claim 26, wherein said plurality of nanocrystals have a predetermined size.

28. The material system of claim 27, wherein said plurality of first and second traps have a predetermined density to control the intensity of the white light emission when excited.

29. A method of tailoring white light emission from a composite having optical properties using ZnSe nanocrystals comprising:

fabricating said ZnSe nanocrystals;
incorporating said ZnSe nanocrystals into a matrix to form a composite; and
tuning the optical properties of said composite to a predetermined
application.

30. The method of claim 29, wherein said optical properties include quantum confined bandedge emission from the ZnSe nanocrystals.

31. The method of claim 29, wherein said tuning of said optical properties is conducted by irradiating said composite.

32. The method of claim 29, wherein said tuning of said optical properties increases the efficiency of the spectral yield of said white light emission by optimizing the number density of the ZnSe nanocrystals.

33. The method of claim 29, wherein said tuning step controls contribution of a blue spectral region of the white light emission from quantum confined bandedge emission of the ZnSe nanocrystals.

34. The method of claim 29, wherein said tuning step controls contribution of blue, red and green portions of the white light emission by controlling the size of the ZnSe nanocrystals and the number of traps in the composite.

35. The method of claim 29, wherein said tuning of said optical properties is conducted by laser irradiating said composite to control amounts of red and green emission from a plurality of traps and to control blue bandedge emission from said ZnSe nanocrystals.

36. The method of claim 29, wherein said fabricating step further includes incorporating said ZnSe in an interface material located between matrix and said ZnSe nanocrystals; and

wherein said interface material is a transparently visible material.

37. The method of claim 36, wherein said interface material is glass.

38. The method of claim 37, wherein said glass material is potassium borosilicate.

39. The method of claim 29, wherein said fabricating step further includes incorporating said ZnSe in an interface material located between matrix and said ZnSe nanocrystals; and

wherein said interface material is a material capable of having nanocrystals embedded within.

40. The method of claim 29, wherein said fabricating step further includes incorporating said ZnSe in an interface material located between matrix and said ZnSe nanocrystals; and

wherein said interface material includes traps capable of emitting light in the red and green region of the spectrum.

41. The method of claim 29, wherein said fabricating step further includes incorporating said ZnSe in an interface material located between matrix and said ZnSe nanocrystals; and

wherein said interface material is a polymer.

42. The method of claim 29, wherein said polymer is polystyrene.

43. The method of claim 29, wherein said fabricating step further includes incorporating said ZnSe in an interface material located between matrix and said ZnSe nanocrystals; and

wherein said interface material is a sol-gel.

44. A material system produced by the method of claim 29.

45. A material system configured to produce white light emission when excited comprising:

a plurality of ZnSe nanocrystals in a predetermined size designed to optimize the contribution of blue light to the white light emission; and

a plurality of traps in a predetermined density designed to adjust the contribution of red and green light to the white light emission.

46. The material system of claim 16, wherein the efficiency of the white light emission is approximately in the range of 50 to 90%.

47. The material system of claim 16, wherein the efficiency of the white light emission is approximately greater than 80%.

48. A material system comprising:
a matrix having nanocrystals and capable of white light emission when fluoresced; and

wherein efficiency of said white light emission is approximately in the range of 50 to 90%.

49. A material system comprising:
a matrix having nanocrystals and capable of white light emission when fluoresced; and
wherein efficiency of said white light emission is approximately greater than 80%.

50. A white light source comprising:
a plurality of nanocrystals;

a plurality of first and second traps; and
said plurality of nanocrystals, first traps and second traps capable of emitting
white light in combination when excited.

51. An LCD comprising:

a plurality of nanocrystals;

a plurality of first and second traps; and

said plurality of nanocrystals, first traps and second traps capable of emitting

white light in combination when excited.

52. An LED comprising:

a plurality of nanocrystals;

a plurality of first and second traps; and

said plurality of nanocrystals, first traps and second traps capable of emitting

white light in combination when excited.

53. An electroluminescent display comprising:

a plurality of composite material substrates each having

a plurality of nanocrystals;

a plurality of first and second traps; and

said plurality of nanocrystals, first traps and second traps capable of

emitting white light in combination when excited.